

EXECUTIVE SUMMARY OF RECENT TRENDS

Climate

It has been shown that the North Pacific atmosphere-ocean system included anomalies during the winter of 2004-05 that were unlike those associated with the primary modes of past variability. This result suggests a combination of two factors: (1) that the nature of North Pacific variability is actually richer in variability than appreciated previously, and (2), that there is the potential for significant evolution in the patterns of variability due to both random, stochastic effects and systematic trends such as global warming. Notably, at the time of this writing, it cannot be determined whether the North Pacific is heading into a positive PDO-like condition or some other state. The Bering Sea (BS) shows three multidecadal regimes in surface air temperatures (SAT) fluctuations: 1921-1939 (warm), 1940-1976 (cold), and 1977-2005 (warm). It is worth noting that the two previous regimes had a similar pattern, when SAT anomalies were strongest at the end of the regime, right before the system switched to a new one. In the current warm regime, the magnitude of SAT fluctuations has been steadily increasing since the mid-1980s, and the Bering Sea may become even warmer before it will switch to a new cold regime. If the regime concept is true, this switch may happen anytime soon, especially given the uncertain state of the North Pacific climate, suggesting that it may be in a transition phase (Rodionov et al., this report).

2004-2005 was a weak El Nino year, with minor or atypical impacts in the North Pacific. Physical data collected on the NMFS Gulf of Alaska (GOA) bottom trawl survey indicate that summer temperatures in 2005 were the warmest on record. There has been a general warming of depths less than 50 m in the GOA (Martin, this report). May 2005 sea surface temperatures in the EBS continued to be warm, indicating that summer bottom temperatures were also warm, since May sea surface temperature is a good predictor of summer bottom temperatures in the EBS (Rodionov, this report).

Biological Trends

Coinciding with the warm conditions in the eastern BS, summer zooplankton biomass has been anomalously low in the past five years (2000-2004) in all four geographic domains (Napp and Shiga, this report). Jellyfish biomass, sampled in the EBS bottom trawl survey, has also been low in the past 5 years (2001-2005) relative to the peak biomass that occurred in 2000 (Lauth, this report). Summer bottom trawl surveys in the EBS, although not designed to sample forage fish, indicate the abundance of sandlance was low during this period (2000-2005) (Lauth, this report). The warming trend in the EBS may have implications for some flatfish because their habitat selection appears to be influenced temporally by varying environmental conditions. Rock sole and flathead sole appear to be distributed further north in warmer conditions (Spencer, this report).

In the GOA, large- and small-scale environmental conditions appear to affect the distribution and abundance of larval fish. Basin-scale environmental conditions in February through April, and local-scale conditions in late-March through early-April, are most influential in terms of prevalence of fish larvae in late spring (Doyle et al., this report). New analyses conducted on the GOA small mesh survey data, to account for spatial and temporal variability in the survey samples, confirm that the GOA biological community shifted after the 1977 climate regime shift. Observed changes include a trend towards increased catches of jellyfish, arrowtooth flounder, walleye pollock, flathead sole and decreased catches of Pandalid shrimp, capelin, Pacific sandfish red king crab, and sculpins. Although, catches of pandalid shrimp increased after 1998, there is no evidence at this time of a rapid community reorganization, such as that which followed the 1976-77 shift (Litzow, this report). Eulachon catches have also been high since about 2001 in both the nearshore GOA small mesh survey and the offshore NMFS GOA bottom trawl survey.

Until 2002, the majority of seabird species showed no discernable population trends in both the BS and GOA. Of those populations that did show a trend, the majority of populations in the SE BS (including the

Pribilof Islands) and GOA were decreasing and, in the SW BS, were increasing. Overall, breeding chronology was early or typical in 2002 for most regions and species within feeding guilds, and in fact there were no cases of later than normal chronology (Fitzgerald et al., this report).

The number of northern fur seal pups born on the Pribilof Islands continued to decline. However, increases in Steller sea lion non-pup counts were observed in 2004 in all areas except the central GOA (slight decline) and the eastern GOA (similar counts as 2002). These time series are updated biennially and updates to these time series in 2006 will indicate whether these trends in marine mammal populations continued. NMFS, along with its research partners in the North Pacific, is exploring several hypotheses to explain these trends, including climate or fisheries related changes in prey quality or quantity, and increases in the rate of predation by killer whales (Sinclair and Testa, this report).

Average species richness and diversity of the groundfish community in the Gulf of Alaska increased from 1990 to 1999 with both indices peaking in 1999 and sharply decreasing thereafter. The spatial distribution of individual species appears to drive changes in species richness. Local species diversity is a function of the number of species and their relative abundance in each haul. Changes in local species richness and diversity are strongly confounded with natural variability in spatial distribution and relative abundance (Mueter, this report).

Annual surplus production (ASP) indices, the sum of new growth and recruitment minus deaths from natural mortality, suggest high variability in groundfish production in the EBS and a decrease in production between 1978 and 2004. Production in the GOA was much lower on average, less variable, and decreased slightly from 1978 to 2004. Because trends in ASP indices are largely driven by variability in walleye pollock in the EBS and variability in walleye pollock and arrowtooth flounder in the GOA, the index was also examined without these stocks included. The results suggest a strong, significant decrease in aggregate surplus production of all non-pollock species from 1978 – 2004 in the Bering Sea and a similar decrease in surplus production aggregated across stocks (excluding pollock and arrowtooth) in the GOA over this period. These trends reflect decreases across many species and are not driven by the next dominant species alone. In the Bering Sea, surplus production of all species except Atka mackerel and northern rockfish has decreased from 1978-2004. In the Gulf of Alaska, long-term trends in ASP were less pronounced but declines were evident for 5 out of the remaining 9 species, while three species showed no obvious long-term trends and (besides arrowtooth flounder) only thornyhead production increased notably from the late 1970s to the 1990s. Long-term declines in ASP and low production in recent years in the EBS are a result of low recruitment, reduced growth, increased natural mortality or some combination thereof. These declining trends suggest that substantial reductions in total catches may be necessary in the near future. It is unclear whether existing levels of precaution implemented at the single-species level will be sufficient to deal with declines in overall system productivity when trying to meet multi-species or ecosystem objectives (Mueter, this report).

Fishing Impacts

Time trends in bycatch of prohibited species are examples of ecosystem-based management indices that may provide early indications of direct human effects on ecosystem components or provide evidence of the efficacy of previous management actions. Interestingly, the bycatch of “other salmon” and herring increased markedly in 2003 and 2004. Between 2002 and 2003, herring bycatch increased by over 600% and “other salmon” bycatch more than doubled. After the dramatic increase in 2003, the herring bycatch increased again by about 42% and “other salmon” bycatch almost doubled in 2004.

Most of the herring bycatch in all years occurs in the BSAI trawl fisheries, primarily during the months of July, August and September with smaller amounts in January through March and October. The recent rise in bycatch can be partly explained by increases of herring biomass; the biomass of Kuskokwim herring, for example, is estimated to have increased by about 34% in 2003 and again by about 32% in

2004. Observer data reveals differences in the distribution of both effort (all pelagic-trawl hauls) and bycatch (hauls with herring in the species composition) over the years 2002-04. In most months of 2003 and 2004, the amount of effort and bycatch increased noticeably in the northwestern-most portions of the fleet's range compared to 2002.

Part of the 2003 increase in "other salmon" bycatch could be explained by the 33% increase in the overall catch of "other salmon" in 2003 compared to 2002. The "other salmon" bycatch nearly doubled again in 2004, despite an almost 6% reduction in the overall catch. In 1994, the North Pacific Fisheries Management Council and NMFS established the Chum Salmon Savings Area (CSSA) in parts of the Bering Sea and at times when salmon bycatch had been highest based on historical observer data. Unfortunately, in both 2003 and 2004 the highest chum salmon bycatch rates were outside of the CSSA and after its closure. Similar problems occurred in 2003 and 2004 with Chinook salmon bycatch outside of the Chinook Salmon Savings Area—the highest bycatch rates were encountered by the pollock trawl fleet outside of the Savings Area after regulations had forced its closure. The resulting Chinook salmon bycatch was about 28% higher in 2003 and 41% higher in 2004 than the long-term average over the period 1994-2002. To address these problems, the Council is considering other means to control salmon bycatch (Hiatt and Terry, this report).

Seabird bycatch in 2002 was the lowest recorded for the longline fleet. Efforts by the longline fleet may have contributed substantially to the observed reduction, although no analysis has been completed to ascertain the contribution of various factors. In 2003 seabird bycatch in the BSAI increased by nearly 40% over 2002, while the bycatch rate remained fairly constant (0.019 vs 0.018 in 2002). The increased bycatch was likely due, in part, to a 28% increase in effort. However, other factors may also have been at work, given the reduction in bycatch between 1998 and 2002 of 84% while effort increased over this time by 23% (Fitzgerald et al., this report).